

Original Research Article

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## Effect of Vermicompost and Zinc on Growth, Yield Attributes and Yield of Greengram [*Vigna radiata* (L.)] Under Semi-Arid Region of Rajasthan

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### ABSTRACT

#### Keywords

Greengram,  
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A field experiment was conducted at College Farm, S. K. N. College of Agriculture, S. K. N. Agriculture University, Jobner, Rajasthan during 2016 to evaluate the influence of different vermicompost and zinc levels on growth and productivity of *kharif* season greengram. The experiment was laid out in a randomized block design, comprising vermicompost levels (control, VC @ 2.5 t ha<sup>-1</sup>, VC @ 5.0 t ha<sup>-1</sup> and VC @ 7.5 t ha<sup>-1</sup>) and zinc levels (control, Zn @ 2 kg ha<sup>-1</sup>, Zn @ 4 kg ha<sup>-1</sup> and Zn @ 6 kg ha<sup>-1</sup>), treatments replicated three times. The increasing levels of vermicompost and zinc increased the chlorophyll content, total number of nodules, effective number of nodules, root density, number of pods per plant, number of seeds per pod, test weight, grain and straw yield in greengram crop. However, the application of vermicompost @ 7.5 t ha<sup>-1</sup> along with zinc @ 6 kg ha<sup>-1</sup> found superior under loamy sand soil.

### Introduction

Greengram [*Vigna radiata* (L.)] is one of the important *kharif* pulse crop. It ranks third among all pulses grown in India after chickpea and pigeonpea. It contains 25 per cent protein. In India, total pulses are grown on 23.46 million ha area with a production of 19.27 million metric tonnes and an average productivity of 789 kg ha<sup>-1</sup> (DES, 2015). Greengram is a rainfed crop predominantly grown in *kharif* in the state of Rajasthan. In Rajasthan, greengram occupy 1.019 lakh ha area and production of 0.391 lakh tones with 384 kg ha<sup>-1</sup> productivity (DOA, 2014). One of the important reasons of low productivity is poor fertility of soil.

There is a great scope for increasing the production of greengram by applying organic manures (FYM/vermicompost) with balanced fertilization and maintaining soil fertility status. The use of vermicompost or other farm wastes to improve the physical, chemical and biological properties of the soil are salient features of efficient rainfed farming. The application of vermicompost not only adds plant nutrients (macro and micro) and growth regulators to the soil but also increases soil water retention, microbial population, humic substances of the soil, mineralization and release of nutrients (Manna and Biswas, 1996). A wide spread deficiency of Zn

particularly in the light textured soils, having low organic carbon and alkaline reaction. In many parts of the country, Zn as a plant nutrient now stands third in importance next to nitrogen and phosphorus (Takkur and Randhawa, 1978). It is one of the essential micronutrient and plays important role in various enzymatic and physiological activities of the plant. It is also essential for photosynthesis and N-metabolism and important for the stability of cytoplasmic ribosome's, and cell division.

The efficiency of native micronutrients is further improved when these are used in conjunction with organic manures especially when the soils are belonging to arid and semi-arid areas having light texture, low in organic carbon, low moisture retention and microbial activity. Hence, the present experiment was carried out to evaluate the influence of vermicompost and zinc on growth, yield attributes and yield of greengram.

### **Materials and Methods**

A field experiment was conducted during *kharif* season of 2016 at College Farm, S.K.N. College of Agriculture, S.K.N. Agriculture University, Jobner, Rajasthan situated at 26.05° N latitude, 75.28° E longitude and at an altitude of 427 m above mean sea level. The soil was loamy sand. The soil had pH value of 8.10, low in available nitrogen (136.60 kg N ha<sup>-1</sup>), medium in available phosphorus (17.50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) and medium in potassium (149.50 kg K<sub>2</sub>O ha<sup>-1</sup>). The experiment was laid out in a randomized block design, comprising vermicompost levels (control, VC @ 2.5 t ha<sup>-1</sup>, VC @ 5.0 t ha<sup>-1</sup> and VC @ 7.5 t ha<sup>-1</sup>) and zinc levels (control, Zn @ 2 kg ha<sup>-1</sup>, Zn @ 4 kg ha<sup>-1</sup> and Zn @ 6 kg ha<sup>-1</sup>), treatments replicated three times. Seed rate 20 kg ha<sup>-1</sup> of greengram variety 'SML- 668' was used in this study. The seeds were inoculated with rhizobium @ 20 gm kg<sup>-1</sup> seed at the time of sowing. Whole

amount of vermicompost as per treatment was broadcasted uniformly at the time of sowing and incorporated in the soil. The recommended dose of nitrogen (20 kg ha<sup>-1</sup>) through urea, phosphorus (30 kg ha<sup>-1</sup>) through DAP, potassium (10 kg ha<sup>-1</sup>) through MOP and zinc through ZnSO<sub>4</sub>.7H<sub>2</sub>O were applied as basal as per treatments.

### **Results and Discussion**

#### **Effect of vermicompost**

Application of increasing levels of vermicompost significantly increased the growth attributes *viz.* chlorophyll content, total number of nodules, effective number of nodules and root density as well as yield attributes such as number of pods per plant, number of seeds per pod and test weight of greengram. The application of vermicompost also enhanced the grain and straw yield of greengram. The significant increase in grain and straw yield under the influence of vermicompost was largely a function of improved growth and yield attributes (Tables 1 and 2). The application of vermicompost @ 7.5 t ha<sup>-1</sup> recorded the maximum value of these parameters. It is an established fact that vermicompost improves the physical and biological properties of soil including supply of almost all the essential plant nutrients for the growth and development of plants. Thus balanced nutrition under favourable environment might have helped in production of new tissues and development of new shoots. Another reason could be efficient and greater partitioning of metabolites and adequate location of nutrients to developing plant structures. As a result almost all growth and yield attributes resulted into significant improvement in yield of crop due to application of vermicompost. These results are in agreement with Tak (2003) in greengram, Sherin and Ahuja (2009) in clusterbean, Meena *et al.*, (2014) in cowpea and Sharma (2016) in mustard.

**Table.1** Effect of vermicompost and zinc on growth attributes of greengram

<b>Treatments</b>	<b>Chlorophyll content at 45 DAS (mg g<sup>-1</sup>)</b>	<b>Total number of nodules</b>	<b>Effective number of nodules</b>	<b>Root density at 45 DAS (cm cm<sup>-3</sup>)</b>	<b>Root density at harvest (cm cm<sup>-3</sup>)</b>
<b>Vermicompost levels (t ha<sup>-1</sup>)</b>					
Control (VC <sub>0</sub> )	3.08	28.08	26.68	4.87	6.56
2.5 (VC <sub>2.5</sub> )	3.59	32.23	30.61	5.71	8.01
5.0 (VC <sub>5.0</sub> )	4.08	35.30	33.35	6.84	8.38
7.5 (VC <sub>7.5</sub> )	4.22	35.71	34.10	7.08	9.18
S.Em <sub>±</sub>	0.06	0.30	0.28	0.04	0.05
CD (P=0.05)	0.17	0.87	0.81	0.12	0.15
<b>Zinc levels (kg ha<sup>-1</sup>)</b>					
Control (Zn <sub>0</sub> )	3.21	28.06	26.60	5.24	6.99
2 (Zn <sub>2</sub> )	3.59	32.39	30.83	5.70	7.73
4 (Zn <sub>4</sub> )	3.98	34.81	33.07	6.44	8.28
6 (Zn <sub>6</sub> )	4.19	36.06	34.25	7.11	9.13
S.Em <sub>±</sub>	0.06	0.30	0.28	0.04	0.05
CD (P=0.05)	0.17	0.87	0.81	0.12	0.15

**Table.2** Effect of vermicompost and zinc on yield attributes and yield of *kharif* greengram

Treatments	Number of pods per plant	Number of seeds per pod	Test weight (g)	Grain yield (kg ha <sup>-1</sup> )	Straw yield (kg ha <sup>-1</sup> )
<b>Vermicompost levels (t ha<sup>-1</sup>)</b>					
Control (VC <sub>0</sub> )	16.03	9.14	34.07	862.18	1977.72
2.5 (VC <sub>2.5</sub> )	18.41	10.10	35.76	1095.26	2487.74
5.0 (VC <sub>5.0</sub> )	20.30	11.07	38.65	1182.17	2839.47
7.5 (VC <sub>7.5</sub> )	20.81	11.39	39.52	1197.27	2968.34
S.Em±	0.12	0.09	0.34	24.04	46.85
CD (P=0.05)	0.35	0.27	0.98	69.43	135.31
<b>Zinc levels (kg ha<sup>-1</sup>)</b>					
Control (Zn <sub>0</sub> )	17.21	9.62	34.12	868.08	1962.74
2 (Zn <sub>2</sub> )	18.02	9.94	35.41	1098.03	2524.43
4 (Zn <sub>4</sub> )	19.63	10.79	38.85	1178.67	2844.19
6 (Zn <sub>6</sub> )	20.68	11.35	39.62	1192.10	2941.89
S.Em±	0.12	0.09	0.34	24.04	46.85
CD (P=0.05)	0.35	0.27	0.98	69.43	135.31

**Table.3** Grain yield (kg ha<sup>-1</sup>) of greengram as influenced by interaction effect of vermicompost and zinc levels

Treatments	VC <sub>0</sub>	VC <sub>2.5</sub>	VC <sub>5.0</sub>	VC <sub>7.5</sub>
Zn <sub>0</sub>	729.20	946.22	998.43	798.45
Zn <sub>2</sub>	870.30	1096.70	1180.30	1244.81
Zn <sub>4</sub>	934.04	1173.67	1264.02	1342.95
Zn <sub>6</sub>	915.18	1164.46	1285.92	1402.85
S.Em±	48.079			
CD (P=0.05)	138.86			

### Effect of zinc

The increasing levels of zinc significantly increased the growth parameters such as chlorophyll content, total number of nodules, effective number of nodules and root density as well as yield attributes number of pods per plant, number of seeds per pod and test weight of greengram. The grain and straw yield were also significantly increased by the application of zinc (Tables 1 and 2). The favourable influence of applied zinc on these growth parameters, yield attributes and yield may be ascribed to catalytic or stimulatory effect of zinc on most of the physiological and metabolic processes of the plant. It also helps in chlorophyll formation and plays an important role in nitrogen metabolism. Thus, the application of zinc in a soil deficient in its content, improved the overall growth and development of plant. The increase in these growth parameters and yield attributes ultimately results into the increased yields due to application of zinc were also reported by Jain (2007), Sharma and Abraham (2010), Dubey *et al.*, (2013) and Jat *et al.*, (2015) in different crops.

### Interaction effect

A significant interactive effect of vermicompost and zinc on grain yield (Table 3) was also observed during present investigation. The increase in grain yield might be due to the fact that vermicompost and zinc had an additive effect and the experimental soil was deficient in nutrients *viz.*, Zn and Fe, supplementation of zinc and vermicompost incorporation improved the overall physical conditions of soil and increased water and nutrient retention in the root zone by reducing infiltration and percolation. Thus, improved the availability of both water and nutrients to plants for their better growth and development and ultimately increased these parameters of greengram.

These findings are in agreement with those of Sharma (2002) on wheat and Sharma *et al.*, (2016) on mustard, also observed beneficial effect of vermicompost and zinc on yield.

On the basis of experimental finding, it can be concluded that, higher growth and yield of the *kharif* greengram crop (var. SML-668) can be obtained with the combined application of vermicompost @ 7.5 t ha<sup>-1</sup> + zinc @ 6 kg ha<sup>-1</sup> under loamy sand soil of semi-arid region of Rajasthan.

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